

Planetary Science Division R&A Program Overview

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Year of the Solar System

Planetary Science Mission Events



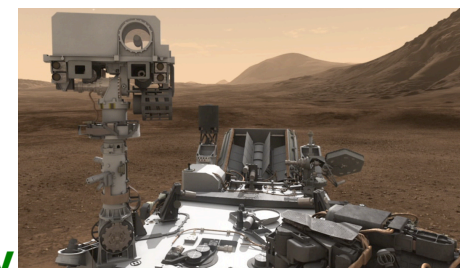
2010

- September 16 – Lunar Reconnaissance Orbiter in PSD
- November 4 - EPOXI encounters Comet Hartley 2
- November 19 - Launch of O/OREOS

• Completed

2011

- February 14 - Stardust NExT encounters comet Tempel 1
- March 7 – Planetary Science Decadal Survey released
- March 17 - MESSENGER orbit insertion at Mercury
- May 5 - Selection of 3 Discovery-class missions for study
- May - Selection of the next New Frontier mission for flight, OSIRIS-Rex
- July 16 - Dawn orbit insertion at asteroid Vesta
- August 5 - Juno launched to Jupiter
- August 9 - Mars Opportunity Rover gets to Endeavour Crater
- September 10 - GRAIL launch to the Moon
- November 26 - Mars Science Laboratory launch to Mars
- December 31 - GRAIL-A (Ebb) orbit insertion at Moon

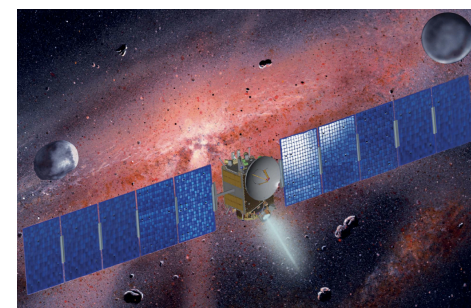


2012

- January 1 - GRAIL-B (Flow) orbit insertion at Moon

Mid-year - Dawn leaves Vesta starts on its journey to Ceres

August - MSL lands on Mars



Questions to Address

1. Actual budget for Planetary R&A for years FY08-FY12
2. Number of grants awarded each FY vs number of proposals received (with selection percentage)
3. Average number of days between award announcement and actual receipt of funds to recipient for each FY

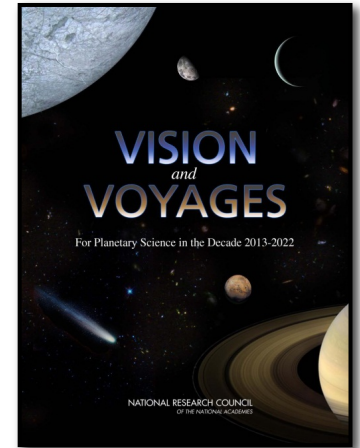
Planetary R&A Program Background

Planetary Science Objectives
Program Elements
Metrics

Planetary Science Objectives

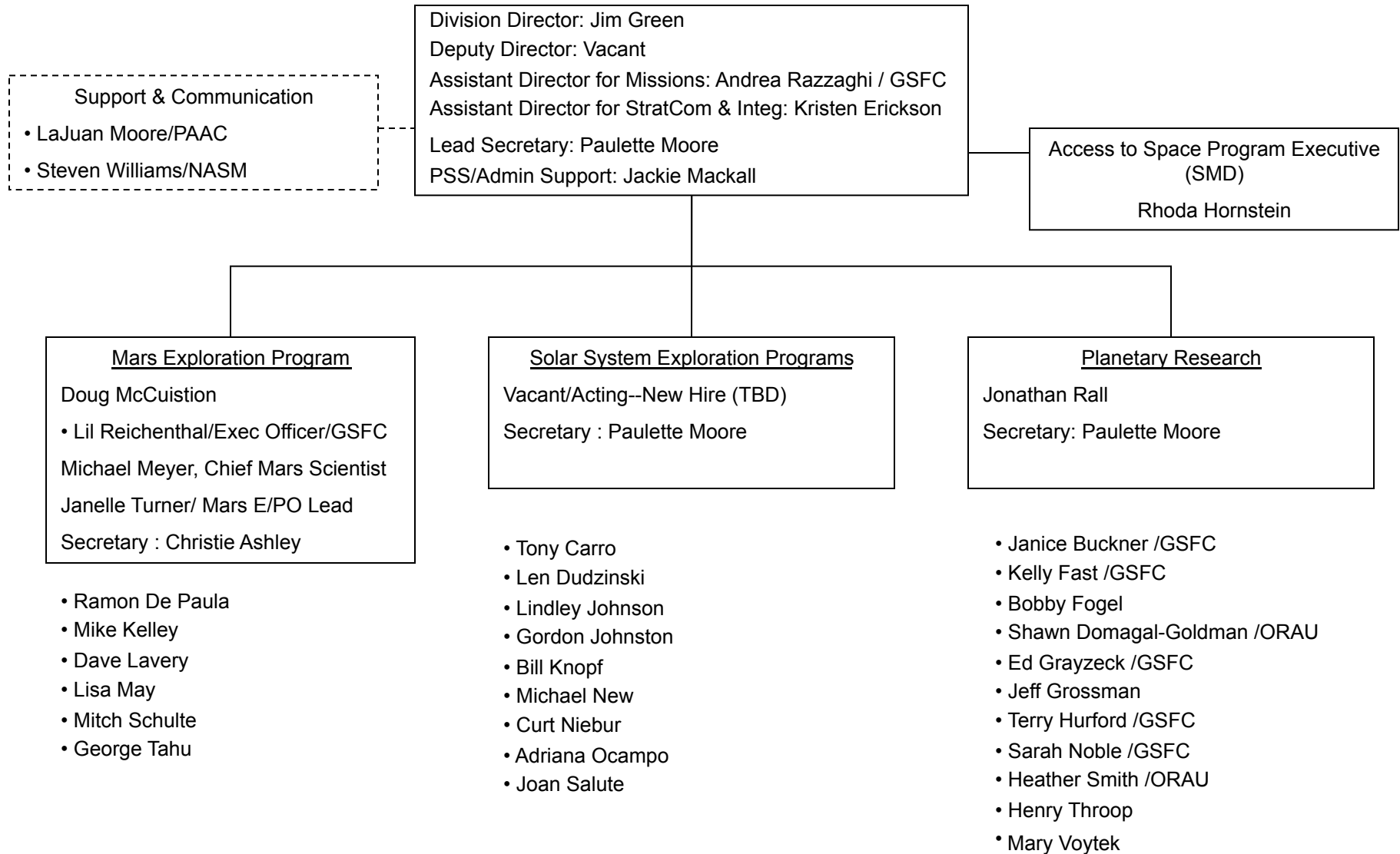
NASA's goal in Planetary Science is to “*Ascertain the content, origin, and evolution of the solar system, and the potential for life elsewhere.*”

- **Planetary Program** seeks to answer fundamental science questions:
 1. What is the inventory of solar system objects and what processes are active in and among them?
 2. How did the Sun's family of planets, satellites, and minor bodies originate and evolve?
 3. What are the characteristics of the solar system that lead to habitable environments?
 4. How and where could life begin and evolve in the solar system?
 5. What are characteristics of small bodies and planetary environments that pose hazards and/or provide resources?



Planetary Science accomplishes these goals through a series of strategic-large, medium, small mission and supporting research

Planetary Science Division



Supporting Research & Analysis (R&A) Program Elements

Planetary Science Research

PGG, Cosmochem, PAST, PATM, PME, PIDDP, Origins, PP, LPI, ASTEP,
ASTID, NAI, Exobiology

Near Earth Objects Observation (NEOO)

Planetary Data Systems (PDS)

Astromaterial Curation

See Background for
definitions of each program

Mars Research & Analysis

Mars Data Analysis Program (MDAP)

Mars Fundamental Research Program (MFRP)

Discovery Research

SRLI DAP/LARS (Lab Analysis of Returned Samples)

PMDAP (Planetary Missions DAP)

MESSENGER/Dawn PSP

GRAIL PSP

Outer Planets Research

OPRP, Cassini DAP/PSP

Lunar Science Research

NLSI, LASER, MMAMA, PGG/Cosmo Lunar, LRO PSP

Call for Proposal to these PSD Program Elements comes out in ROSES

Programs vs Objectives

Relevance of activities to the PSD science objectives (●=directly relevant, O=somewhat relevant)					
Program Element	Objective 1 Objects, processes	Objective 2 Origin, Evolution	Objective 3 Habitability	Objective 4 Life: Earth, elsewhere	Objective 5 Small Bodies
Astrobiology-Exobiology & Evolutionary Biology	O	O	●	●	
Astrobiology Science & Technology Instrument Development	O	O	●	●	
Astrobiology Science & Technology for Exploring Planets	O		●	●	
Cassini Data Analysis	●	●	●	O	O
Cosmochemistry	●	●	O	O	●
Laboratory Analysis of Returned Samples	●	●	O	O	O
Lunar Advanced Science Exploration Research	●	O		●	●
Mars Data Analysis	●	●	●	●	O
Mars Fundamental Research	●	●	●	O	
Mars Instrument Development	●	●	●	●	
Moon & Mars Analog Missions Activities	●	●	●	●	O
NASA Astrobiology Institute	O	O	●	●	
NASA Lunar Science Institute	O	●			O
Near-Earth Object Observations	●	O			●
Origins of Solar Systems	●	●	O	O	
Outer Planets Research	●	●	O		O
Planetary Astronomy	●	●	●		●
Planetary Atmospheres	●	●	O	O	
Planetary Geology & Geophysics	●	●	●		O
Planetary Instrument Definition & Development	●	●	●	●	●
Planetary Mission Data Analysis	●	●	O		●
Planetary Protection Research			●	●	O

Programs vs Objectives (cont.)

Relevance of activities to the PSD science objectives (●=directly relevant, ○=somewhat relevant)					
Supporting Infrastructure Activities	Objective 1 Objects, Processes	Objective 2 Origin, Evolution	Objective 3 Habitability	Objective 4 Life: Earth, elsewhere	Objective 5 Small Bodies
Curation	●	●	○	○	●
Infrared Telescope Facility	●	●	●	●	●
Lunar and Planetary Institute	●	●	●	●	●
Mars Climate Modeling Center (proposed)	○	○	●	●	
NASA Advanced Supercomputing	●	○	○	○	○
National Astronomy & Ionosphere Center/Arecibo Planetary Radar System	●	●			●
Planetary Aeolian Laboratory	●	○	○		
Planetary Cartography	●	●	●		●
Planetary Major Equipment	●	●	●	●	○
Planetary Data System	●	●	●	●	●
Reflectance Experiment Laboratory	●	○	●		●
Regional Planetary Image Facility	●	○	○	○	○
Venus Chamber	●	●	○		
Vertical Gun Laboratory	●	●	○	○	●

- Independent review validates how our R&A program elements addresses Planetary Division Goals and Objectives

GPRA Performance Metrics

Outcome 2.3					
Ascertain the content, origin, and evolution of the solar system and the potential life elsewhere.					
FY 2011 Performance Goal					FY 2011
Provide national scientific capabilities through necessary skilled researchers and supporting knowledge base.					2.3.1.1 Green
FY 2011 Annual Performance Goals	FY07	FY08	FY09	FY10	FY 2011
Demonstrate planned progress in inventorying solar system objects and identifying the processes active in and among them. Progress relative to the objectives in NASA's 2010 Science Plan will be evaluated by external expert review.	None	None	None	None	PS-11-1 Green
FY 2011 Annual Performance Goals	FY07	FY08	FY09	FY10	FY 2011
Demonstrate planned progress in understanding how the Sun's family of planets, satellites, and minor bodies originated and evolved. Progress relative to the objectives in NASA's 2010 Science Plan will be evaluated by external expert review.	7SSE1 Green	8PS01 Green	9PS1 Green	10PS01 Green	PS-11-4 Green
FY 2011 Annual Performance Goal	FY07	FY08	FY09	FY10	FY 2011
Demonstrate planned progress in understanding the processes that determine the history and future of habitability of environments on Mars and other solar system bodies. Progress relative to the objectives in NASA's 2010 Science Plan will be evaluated by external expert review.	7SSE6 Green	8PS06 Green	9PS8 Green	10PS09 Green	PS-11-8 Green
FY 2011 Annual Performance Goal	FY07	FY08	FY09	FY10	FY 2011
Demonstrate planned progress in understanding the origin and evolution of life on Earth and throughout the biosphere to determine if there is or ever has been life elsewhere in the universe. Progress relative to the objectives in NASA's 2010 Science Plan will be evaluated by external expert review.	7SSE4 Green	8PS04 Green	9PS5 Green	10PS07 Green	PS-11-11 Green
FY 2011 Annual Performance Goal	FY07	FY08	FY09	FY10	FY 2011
Demonstrate planned progress in identifying and characterizing small bodies and the properties of planetary environments that pose a threat to terrestrial life or exploration or provide potentially exploitable resources. Progress relative to the objectives in NASA's 2010 Science Plan will be evaluated by external expert review.	7SSE8 Green	8PS08 Green	9PS9 Green	10PS10 Green	PS-11-12 Green

GPRA Performance Metrics

Uniform and Efficiency Measures					
	FY07	FY08	FY09	FY10	FY 2011
Complete all development projects within 110 percent of the cost and schedule baseline.	7SSE10 Red	8PS09 White	9PS11 Red	10PS15 White	PS-11-14 Green
Deliver at least 90 percent of scheduled operating hours for all operations and research facilities.	7SSE11 Green	8PS10 Green	9PS12 Green	10PS16 Green	PS-11-15 Green
Peer-review and competitively award at least 95 percent, by budget, of research projects.	7SSE12 Green	8PS11 Green	9PS13 Green	10PS13 Green	PS-11-16 Green
Reduce time within which 80 percent of NASA Research Announcement (NRA) grants are awarded, from proposal due date to selection, by four percent per year, with a goal of 180 days.	7SSE13 Red	8PS12 Green	9PS14 Green	10PS14 Red	PS-11-17 Red
<p>Why NASA rated Uniform and Efficiency Measure PS-11-17 Red: This annual performance target was not met, for the time to complete its grant proposal evaluation and selection process, by the Planetary Science Division, within the Science Mission Directorate. The targeted amount of time was missed by 76 days, approximately 35% of the planned time. The time to award was impacted by the year-long Continuing Resolution, on the order of a 50 day delay, on average, across the Science Mission Directorate. It is estimated that without the impact of the Continuing Resolution, the Planetary Science Division would have missed its target regardless. Other factors contributing to the missed target included staffing transitions in positions key to this process during FY 2011 (new Research & Analysis Lead and new program scientists). The involvement of these scientists in critical mission activities for multiple 2011 launches (Juno, GRAIL, MSL), as well as multiple FY 2011 Announcements of Opportunity also prevented improvement.</p>					

Program Yearly Budget and Distribution

NASA PLANETARY RESEARCH AND DATA ANALYSIS PROGRAMS			
PROGRAM	FY10	FY 11	FY 12
AstroCuration	4.473	5.509	6.000
Near-Earth Objects	5.800	7.848	20.425
Hayabusa Participating Scientist Program	0.259	0.304	0.000
Planetary Data System	10.120	11.504	14.000
New Horizons at Jupiter Data Analysis Program	1.234	1.188	0.000
Cassini Data Analysis (CDAP)	4.035	5.527	5.610
Outer Planets Research (OPR)	7.922	11.998	11.880
Mars Multi-Mission DA & Data Products	1.126	0.274	0.054
Mars Fundamental Research Program	7.091	7.601	8.767
Mars Data Analysis Program (MDAP)	7.737	8.375	9.073
Mars Phoenix DAP	0.000	1.093	0.804
MER Participating Scientist Program	4.172	0	0.000
Mars Instrument Development Prog (MIDP)	2.677	1.051	0.000
Sample Ret Lab Inst & Data Anlys (SRLIDAP)	3.947	10.693	9.513
Discovery Data Analysis (DDAP now PMDAP)	2.094	2.516	3.500
Messenger Participating Scientist Program	1.146	2.240	2.376
DAWN Participating Scientist Program	0.555	1.670	1.710
Planetary Geology & Geophysics (PGG)	10.044	12.116	11.889
Cosmochemistry (COSMO)	11.670	12.331	14.507
Planetary Astronomy (PAST)	9.963	9.045	10.163
Planetary Atmospheres (PATM)	8.753	8.915	9.100
Planetary Instrument Def & Dev (PIDDP)	10.086	8.503	10.946
Origins of the Solar System (ORIGINS)	5.267	5.272	7.118
Neo-Wise/NEO	1.800	0.660	0.276
Planetary Protection	3.190	2.512	2.540
Astrobio Sci & Tech for Expl Planets (ASTEP)	6.157	9.530	13.322
Astrobiology Inst Development (ASTID)	6.805	7.684	8.128
National Astrobiology Institute (NAI)	19.875	20.790	27.292
Exobiology/Evolutionary Biology (EXO)	14.744	16.52	15.000
Planetary R&A (misc)	13.201	3.307	4.530
Venus Express	1.080	1.056	1.080
Planetary Science US Participating Investigator Program	0.752	0.712	0.305
NLSI	11.535	13.859	9.319
Lunar Reconnaissance Orbiter Participating Scientist (LRO PSP)	1.290	0.866	0.000
Lunar Advanced Science & Exploration Research (LASER)	4.325	6.878	8.419
Moon and Mars Analog Mission Activities	0.714	0.580	0.711
GRAIL Guest Scientist Program			0.750
Total R&A Budget	205.639	220.527	249.109
Overall Planetary Budget	1,364.400	1,446.180	1500.000
R&A as % of Budget	15.1%	15.2%	16.6%

Yearly Totals

FY03: \$152M

FY04: \$177M

FY05: \$185M

FY06: \$163M

FY07: \$149M

FY08: \$180M

FY09: \$207M

FY10: \$206M

FY11: \$221M

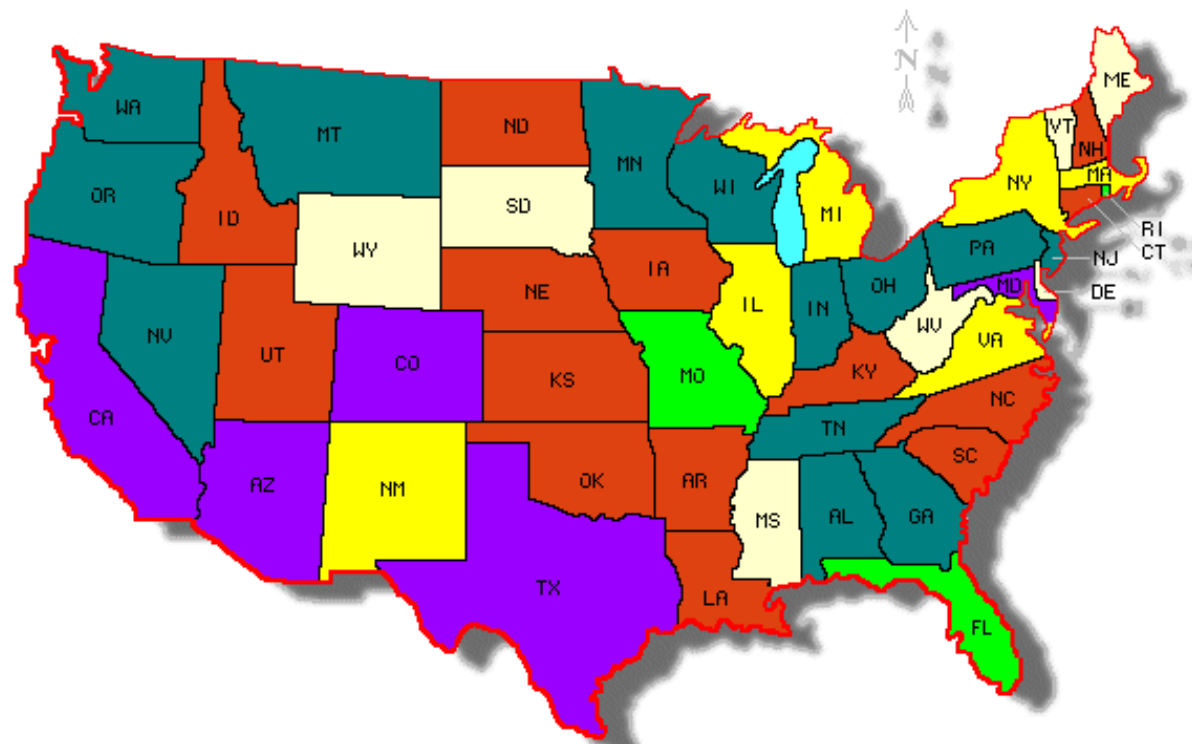
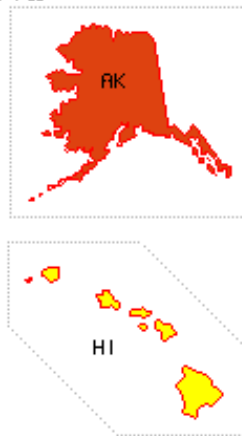
FY12: \$249M

(Planned)

Geographic Distribution of Grants – PIs

Concentration of PSD PIs

- = 0 PIs
- = 1-4 PIs
- = 5-9 PIs
- = 10-14 PIs
- = 15-50 PIs
- = > 50 PIs

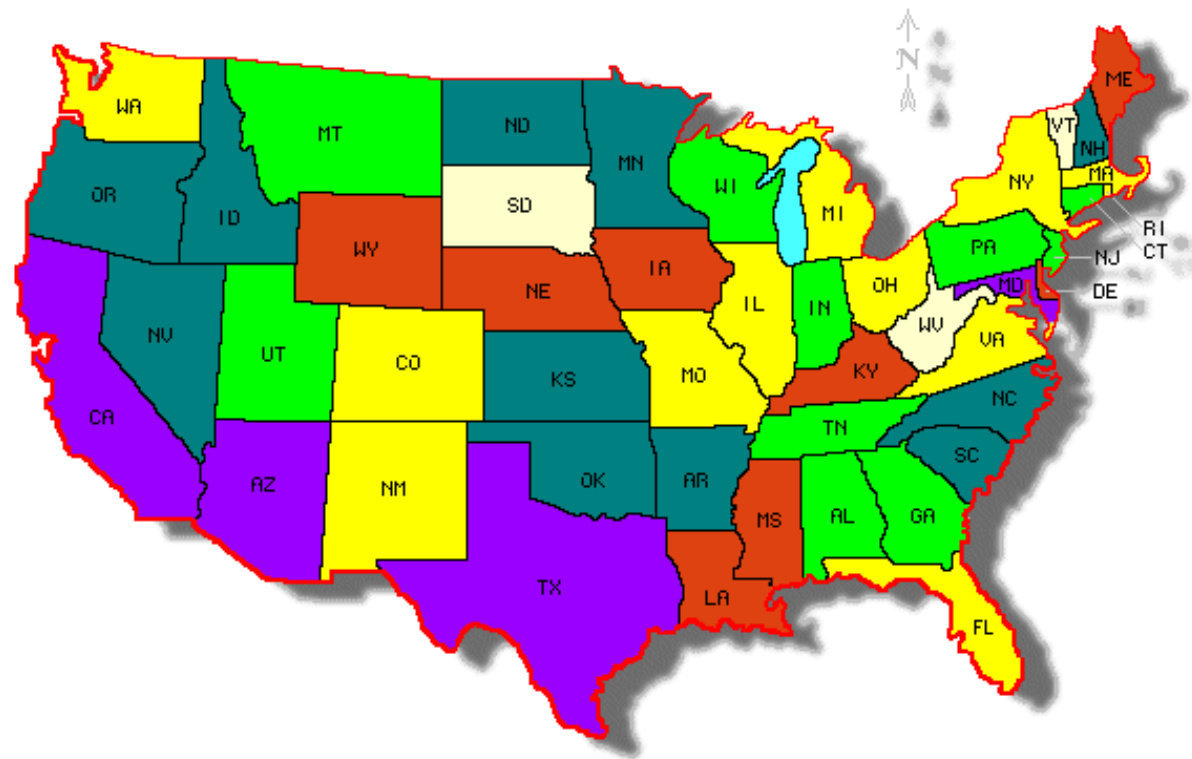
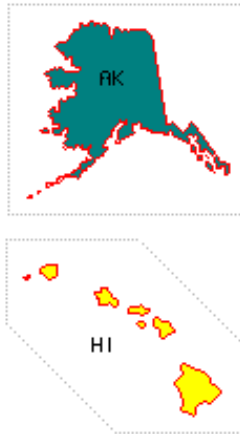


NOTES:
2008 to 2011

Geographic Distribution of Grants – \$

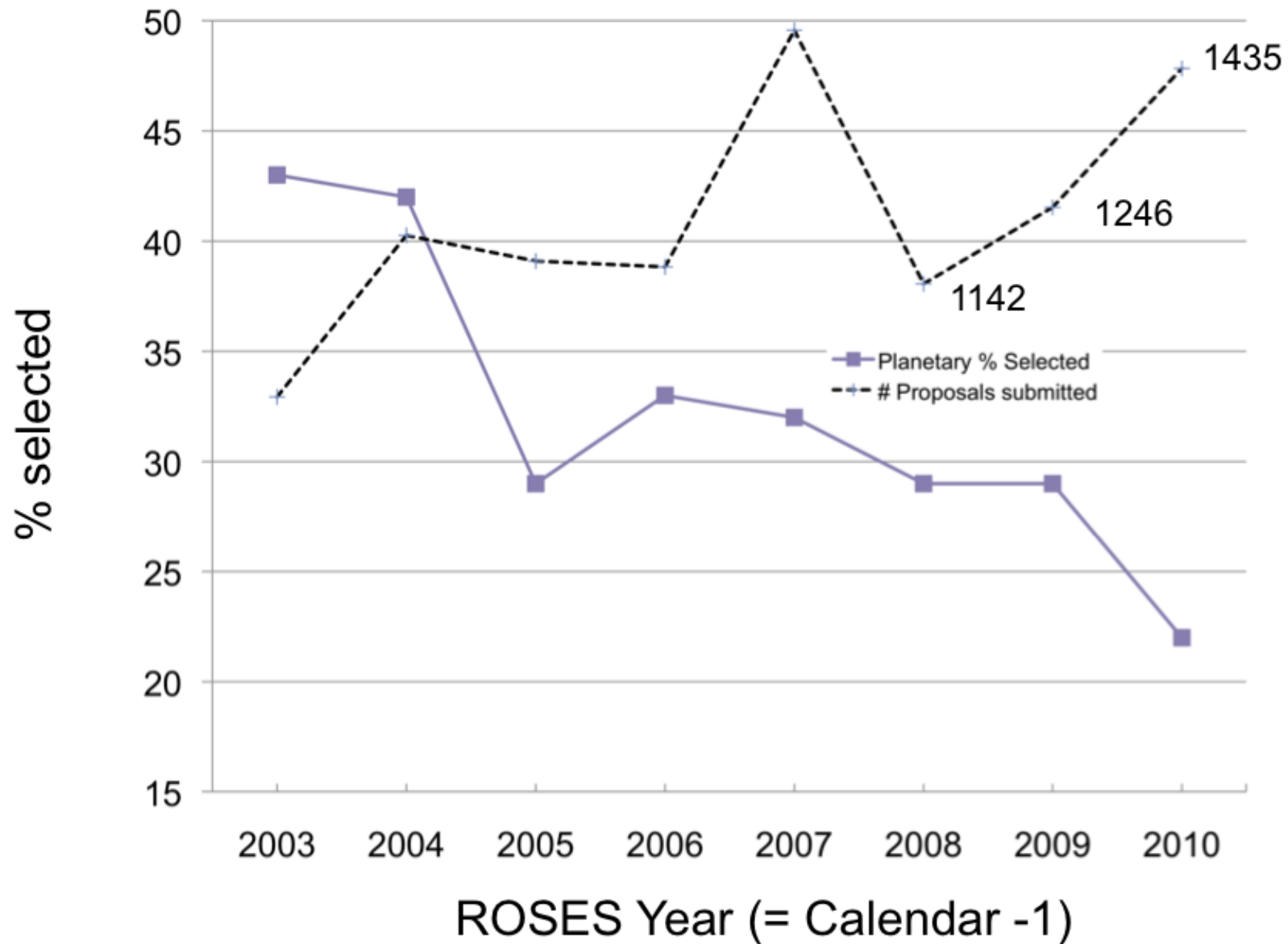
Average Annual Funding from the PSD R&A Program (2008–2011)

- \$0.00 USD
- \$1K to \$99K
- \$100K to \$499K
- \$500K to \$999K
- \$1M to \$9.9M
- \$10M to \$50M

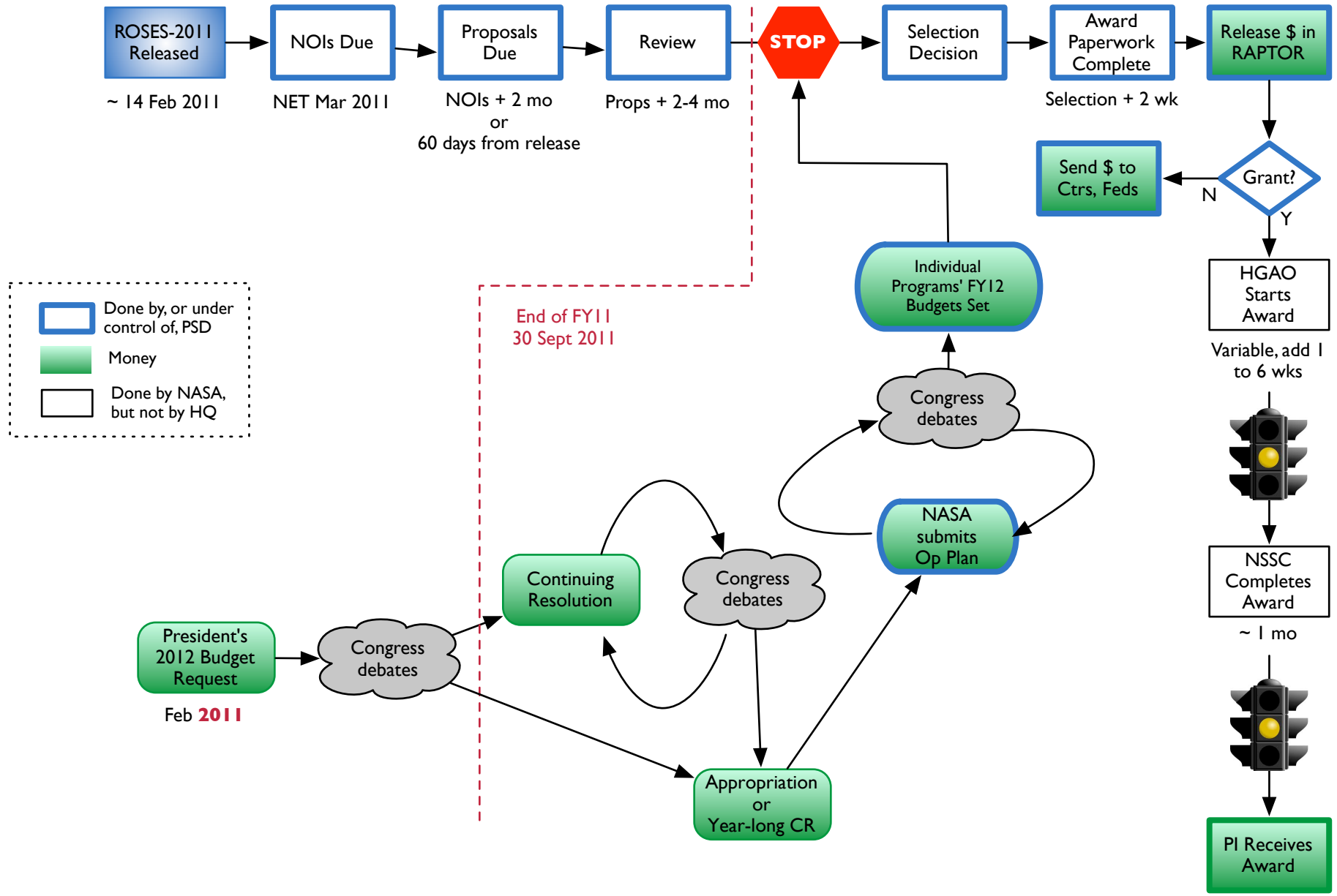


Proposals and Award Information

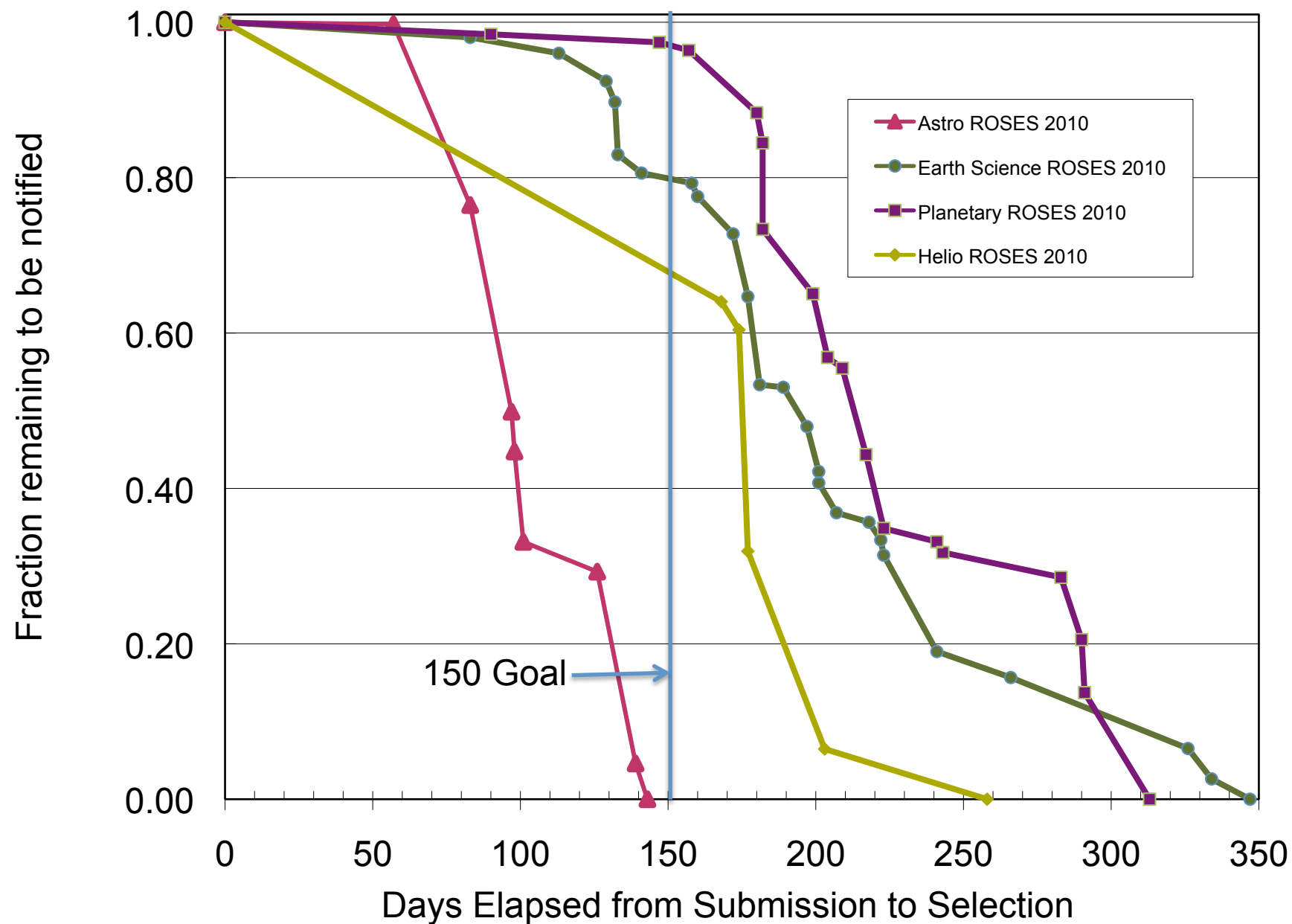
ROSES PSD % vs # over time



Selection Process and Award



Time from Submission to Award



SARA : Service and Advice for R&A

The image shows a screenshot of the NASA SARA (Service and Advice for Research and Analysis) website. The browser address bar displays 'http://science.nasa.gov/researchers/sara/'. The website header includes the NASA logo and navigation links such as 'Home', 'Big Questions', 'Earth', 'Heliophysics', 'Planets', 'Astrophysics', 'Missions', 'Technology', and 'Science News'. The main content area is titled 'NASA SCIENCE FOR RESEARCHERS' and features a sidebar with a 'For Researchers' menu. This menu includes links to 'SARA : Service and Advice for Research and Analysis', 'Subscribe/Contact SARA', 'Advisory Committees', 'Events Calendar', 'Division Corner', 'FAQs', 'Grant Solicitations', 'Grant Stats', 'Program Officers List', 'How To Guide', 'Letters from SARA', 'Library (and useful links)', 'Newsletters', 'Science Matters', 'Student Programs', and 'Education & Public Outreach'. The 'Division Corner' link is highlighted with a blue arrow. The main content area displays the 'PLANETARY SCIENCE DIVISION CORNER' with a list of links including 'NASA Presentations from the 2012 LPSC Conference', 'Planetary Budget Spreadsheet Presented at LPSC 2012', 'Video of Jim Green TEDxNASA comet encounter talk', 'Planetary-Related NASA Research and Data Analysis Programs Final Budgets (FY2003-FY2010)', 'Planetary Science Technology Development: What are we thinking (340 KB)', 'Video of Green presentation at NASA night DPS - Oct 14, 2008', 'Hertz presentation to SSB Mission-Enabling committee (9.9 MB) | Text-only .rtf format', 'Planetary Science R&A Update Spring 2008', and 'Planetary-Related NASA Research and Data Analysis Programs Final Budgets (FY2003-FY2007)'. Below this is the 'Planetary Science Decadal Survey' section, which includes a download link for 'Visions and Voyages for Planetary Science in the Decade 2013-2022' (9.7 MB) and a description of the survey's purpose.

- Designed to provide:
 - Transparency – Division statistics and information
 - Open communication - Express anonymous concerns to be resolved

Summary

- Planetary program has an extensive R&A program to maximize science return from our missions and to enable futures missions
 - Support our established goals
 - Has recently completed an external review
 - Reports program metrics/accomplishments to the administration and Congress (GPRA)
- The Peer Review process is the *best way* to accomplish this program but it is *time consuming*
- Manage nearly a 1000 grants/year with limited staff
- R&A is a science goal driven program and NOT driven by proposal pressure
 - Planetary's R&A program is HIGHLY competitive



50 YEARS

Background

solar system exploration

Planetary R&A Programs Elements

- PGG - Planetary Geology & Geophysics – supports scientific investigations of planetary surfaces & interiors, satellites, ring systems, comets & Asteroids
- Cosmochemistry - supports scientific investigations of extraterrestrial material aimed at understanding solar system bodies as well as dust.
- LARS - Laboratory Analysis of Returned Samples – goal is to maximize scientific return of returned samples from missions such as Stardust, Genesis & Hayabusa
- Planetary Astronomy - supports ground-based astronomical observations and suborbital investigations using sounding rockets & balloons from UV to radio wavelengths
- Planetary Atmospheres - supports scientific investigations to understand origins and evolution of atmospheres, planets & satellites and comets.
- NEOO - Near Earth Object Observations – goal is to discover all NEOs with diameters ≥ 1 km and to characterize that population.
- Origins - Origins of the Solar System – seeks to understand how the terrestrial planets, moons, giant planets were formed and evolved into our present state
- Planetary Protection Research – goal is to prevent biological contamination on outbound and sample return missions to other planetary bodies.
- PIDDP - Planetary Instrument Definition & Development Program - supports the advancement of spacecraft-based instrumentation technology that shows promise in scientific investigations on future planetary missions

Astrobiology (NAI, ASTID, ASTEP, Exobiology)

- NAI - NASA Astrobiology Institute
- Astrobiology: Exobiology & Evolutionary Biology – goal is to understand the origin, evolution, distribution and future of life in the Universe. Research is centered on the origin and early evolution of life, the potential of life to adapt to different environments and implications for life elsewhere
- ASTID - Astrobiology Science & Technology for Instrument Development - goal is to develop instrumentation to help meet astrobiology science requirements on future flight missions as well as unique astrobiology objectives on Earth
- ASTEP - Astrobiology Science & Technology for Exploring Planets – support the development of astrobiologically relevant, miniaturized instrumentation capable of extensive operations on lunar & planetary surfaces throughout the Solar System
- Mission Concept Development for Astrobiology Small Payloads

Lunar Science Research

- These programs are jointly supported by PSD and HEOMD/ESMD for the last several years
- NLSI - NASA Lunar Science Institute
- LASER - Lunar Advanced Science & Exploration Research – funds basic and applied lunar science and exploration.
- MMAMA - Moon & Mars Analog Missions Activities – addresses the need for integrated interdisciplinary field experiments as an integral part of preparation for planned human and robotic missions to asteroids, the Moon and/or Mars.
- LRO PSP – Lunar Reconnaissance Orbiter Participating Scientist Program – objective is to enhance the scientific return of the LRO mission by broadening the scientific participation in the mission science planning and data analysis.

Outer Planets

- OPR - Outer Planets Research – supports diverse scientific investigations that contribute to the understanding of the outer Solar System including the giant planets, their satellites and smaller bodies including comets, asteroids, and Kuiper Belt objects.
- CDAP - Cassini Data Analysis Program – goal is to enhance the scientific return of the Cassini mission by broadening the scientific participation in the analysis & interpretation of the returned data. Also supports participating scientists.

Discovery Research

- PMDAP - Planetary Mission Data Analysis Program – objective is to enhance the scientific return of Planetary Science Division missions by broadening the scientific participation in the analysis of archived data collected by those missions (e.g. Dawn, Deep Impact, Deep Space 1, EPOXI, Galileo, Giotto, Hayabusa, Magellan, NEAR, MESSENGER, Pioneer Venus, Stardust-NExT, + others)
- PSP - MESSENGER Participating Scientist Program - objective is to enhance the scientific return of the MESSENGER mission by broadening the scientific participation in the mission science planning and data analysis.

Mars Research & Technology

- MDAP - Mars Data Analysis Program - objective is to enhance the scientific return from missions to Mars conducted by NASA and other space agencies
- MFRP - Mars Fundamental Research Program – seeks to sponsor the best and most innovative scientific research concerning the atmospheric, climatological, geologic, geophysical and geochemical processes on Mars.
- MIDP - Mars Instrument Development Project – supports the advancement of spacecraft-based instrumentation technology that shows promise in scientific investigations on future Mars missions
- Mars Technology Project – Seeks to ensure that appropriate spacecraft technologies are available in a sufficiently mature state to support the challenges of the Mars Exploration Program